



Electricity and development: Global trends and key challenges

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Electricity and Development: Global Trends and Key Challenges

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Risoe National Laboratory

Energy and Development Workshop

Asian Institute of Technology

Bangkok, Thailand

28-29 April 2005

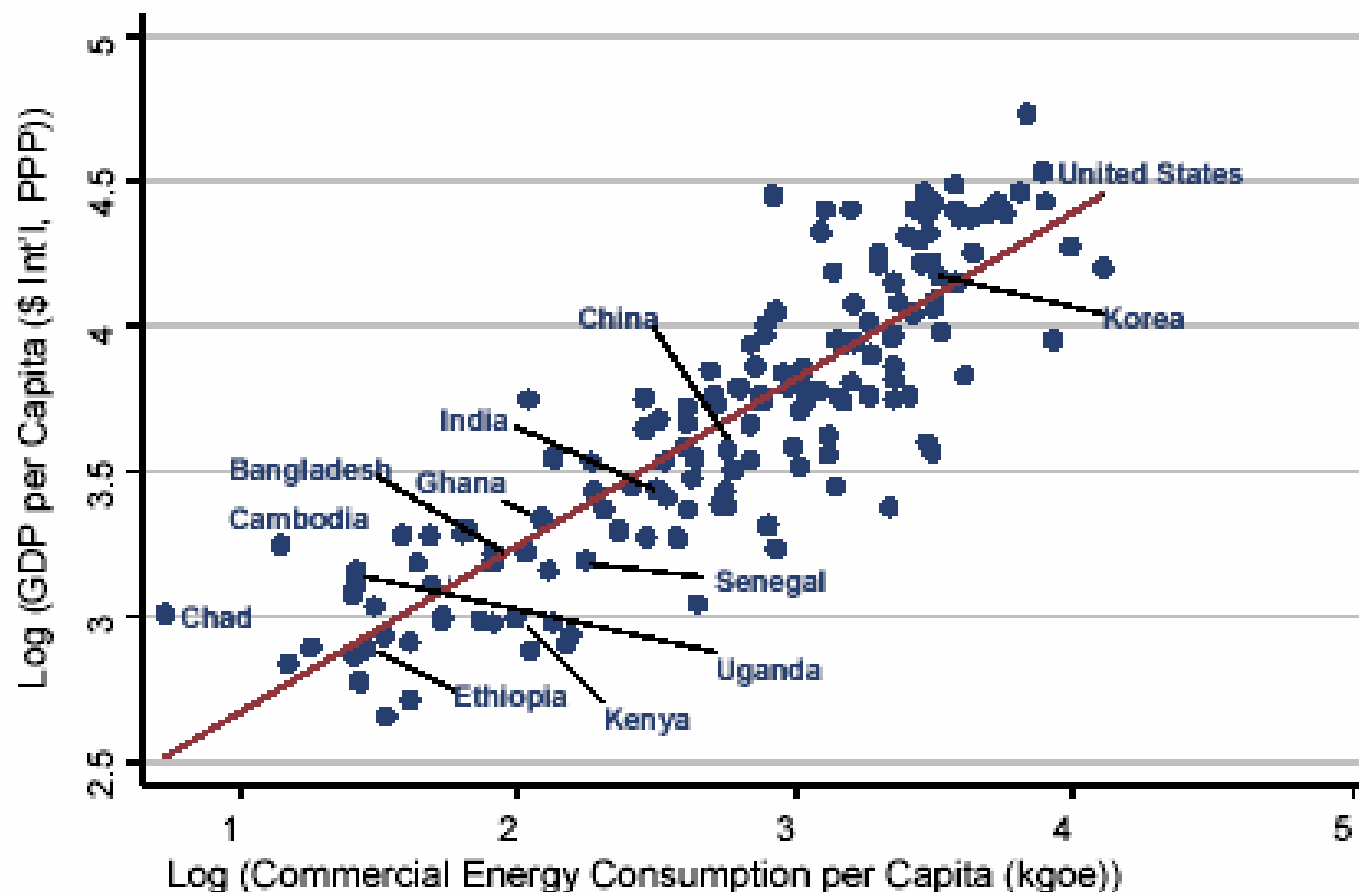
Structure of presentation

- Economic growth implications
- Human development implications
- Prospects for electricity development
- Investment requirements
- Key challenges
- Final remarks



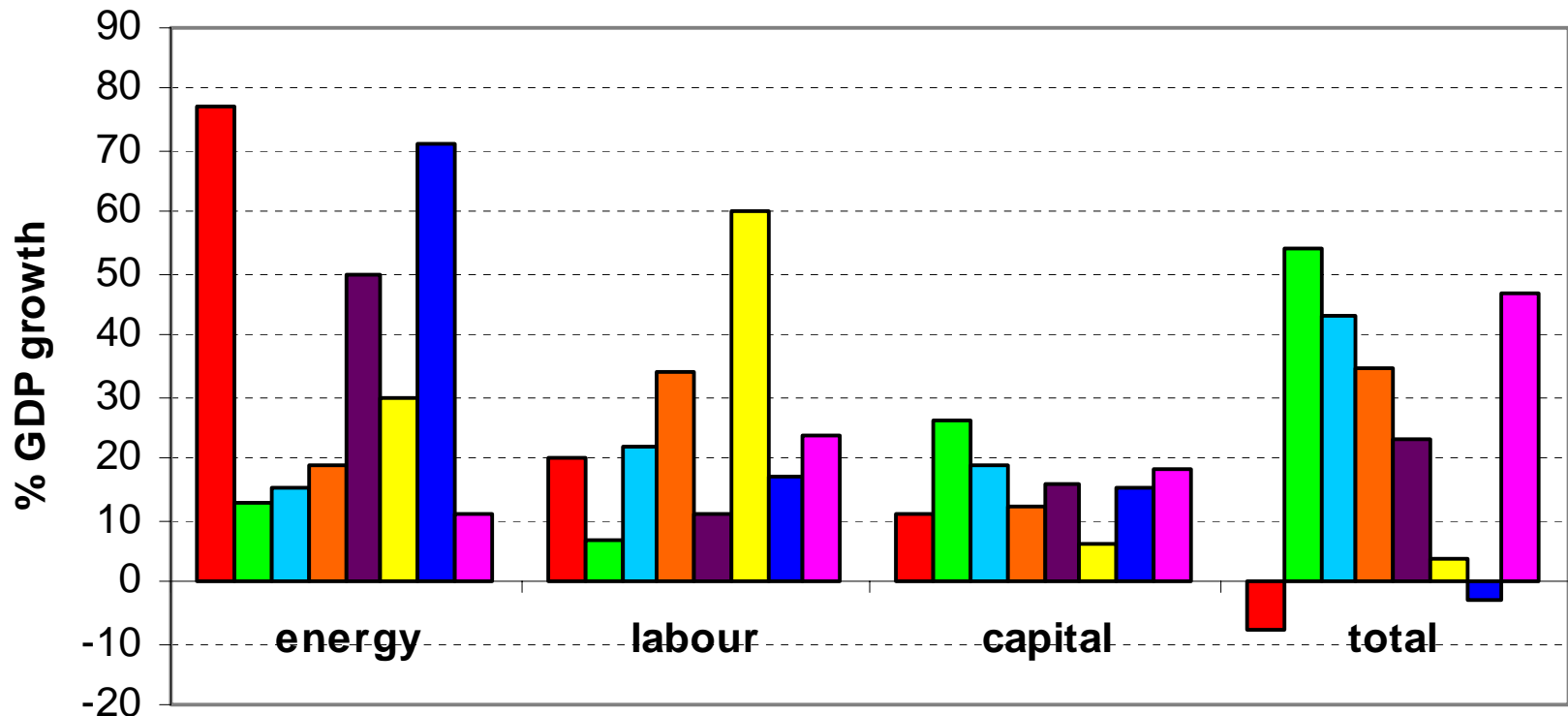
1. Energy and economic growth

National income and consumption per capita



1. Energy and economic growth

Contribution of factors of production and productivity to GDP growth
1980-2001



■ Brazil (2.4%) ■ China (9.6%) ■ India (5.6%) ■ Indonesia (5.1%)
 ■ Korea (7.2%) ■ Mexico (2.2%) ■ Turkey (3.7%) ■ US (3.2%)

Source of data: IEA,
2004

2. Energy and Human Development

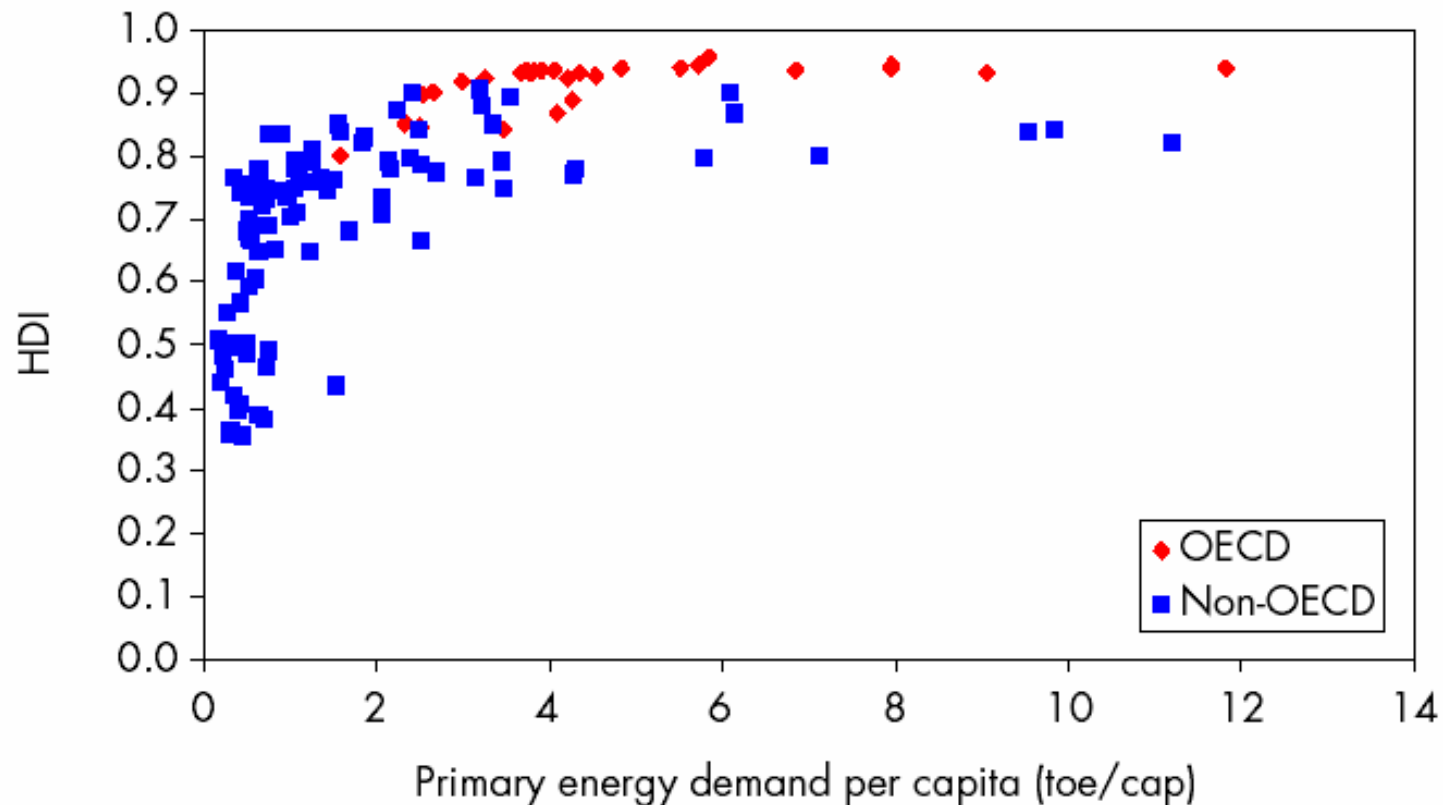
Human development index

- **Longevity**
 - life expectancy at birth
- **Knowledge**
 - adult literacy rate and the combined gross primary, secondary, and tertiary enrolment ratio
- **Decent standard of living**
 - GDP per capita (PPP US\$)

2. Energy and Human Development

Per capita energy consumption

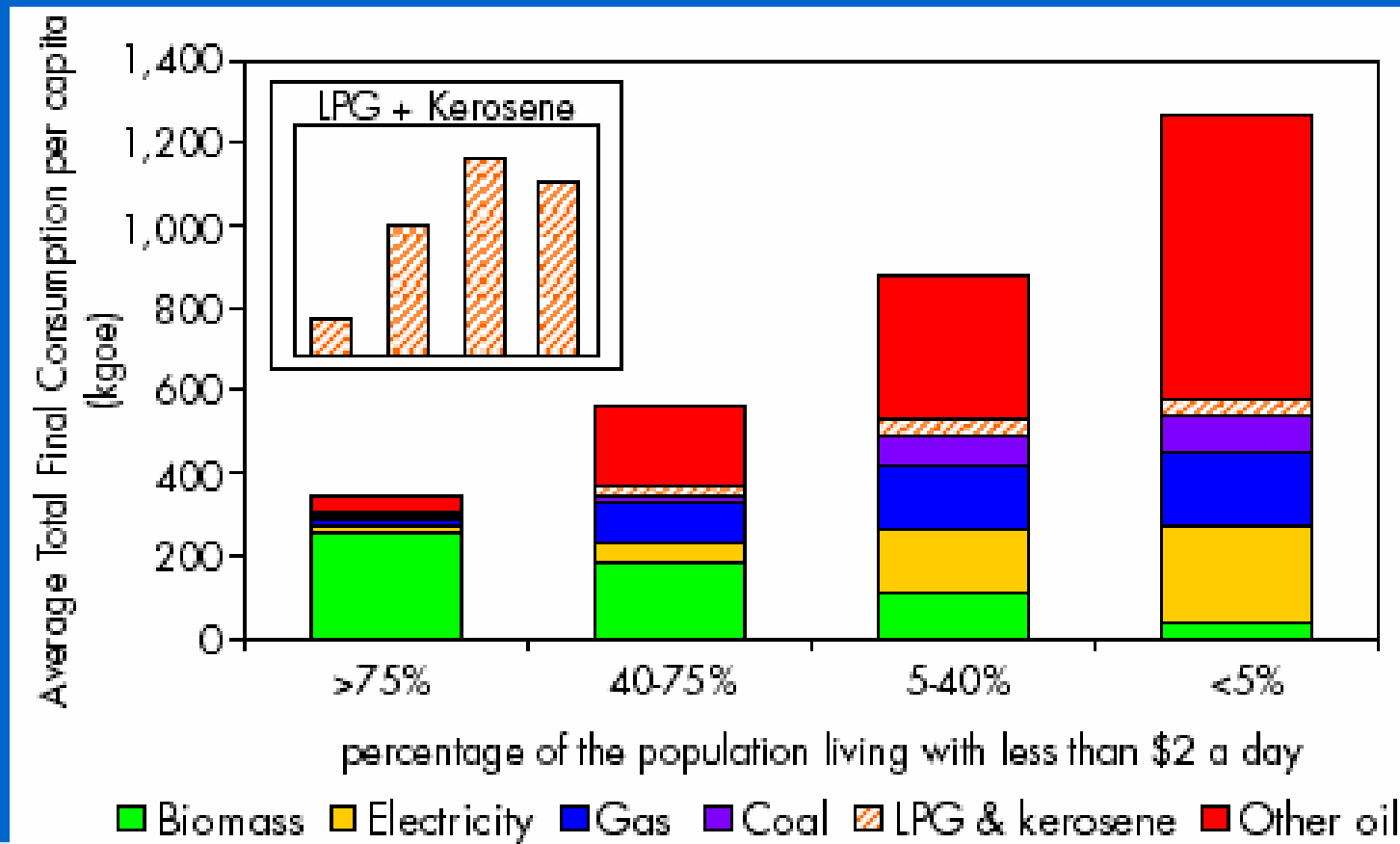
HDI and primary energy demand per capita in 2002



2. Energy and Human Development

Per capita energy consumption and poverty

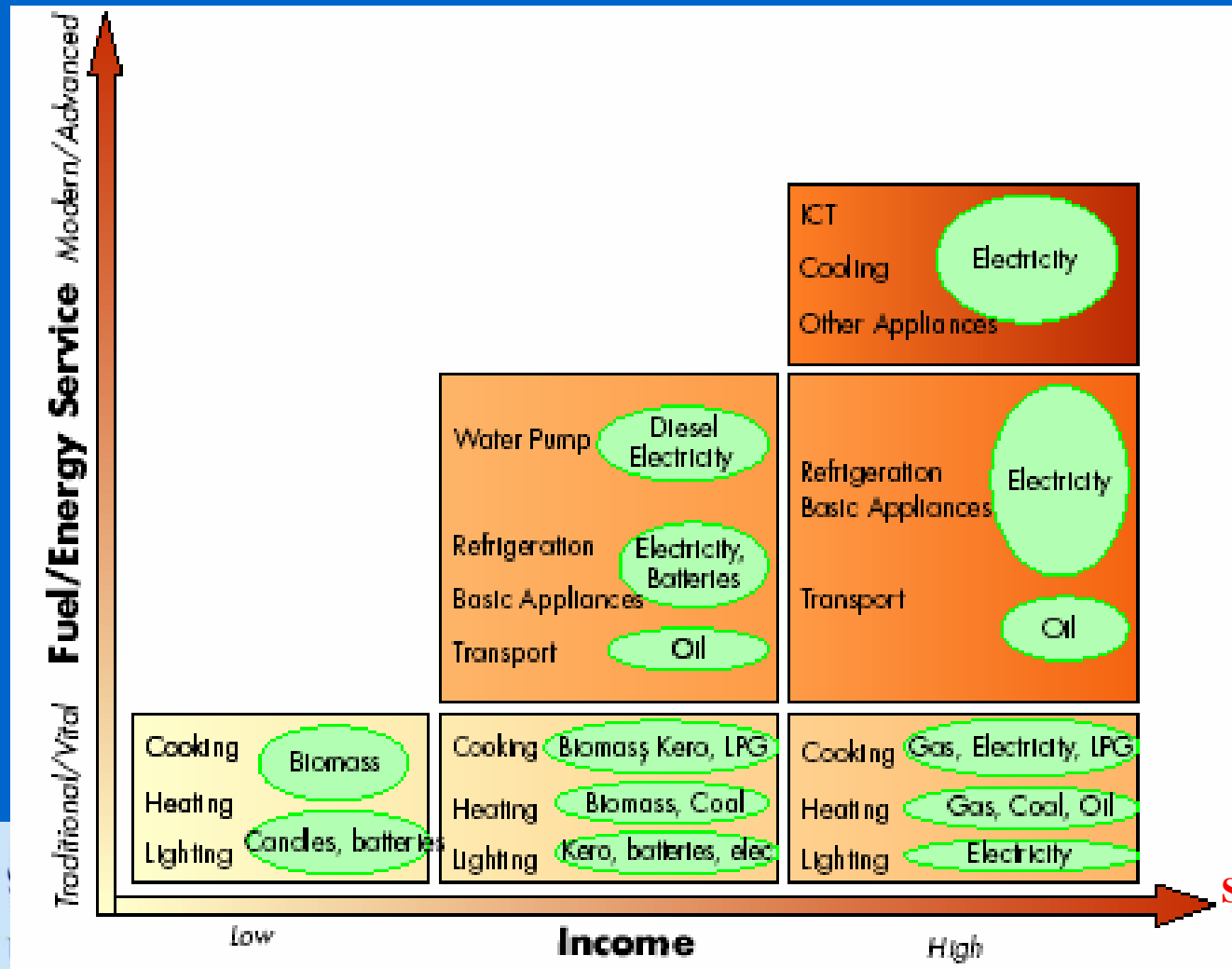
Average final energy demand per capita and population with >\$2/day in 2000



2. Energy and Human Development

Transition to modern energy services

Household fuel transition

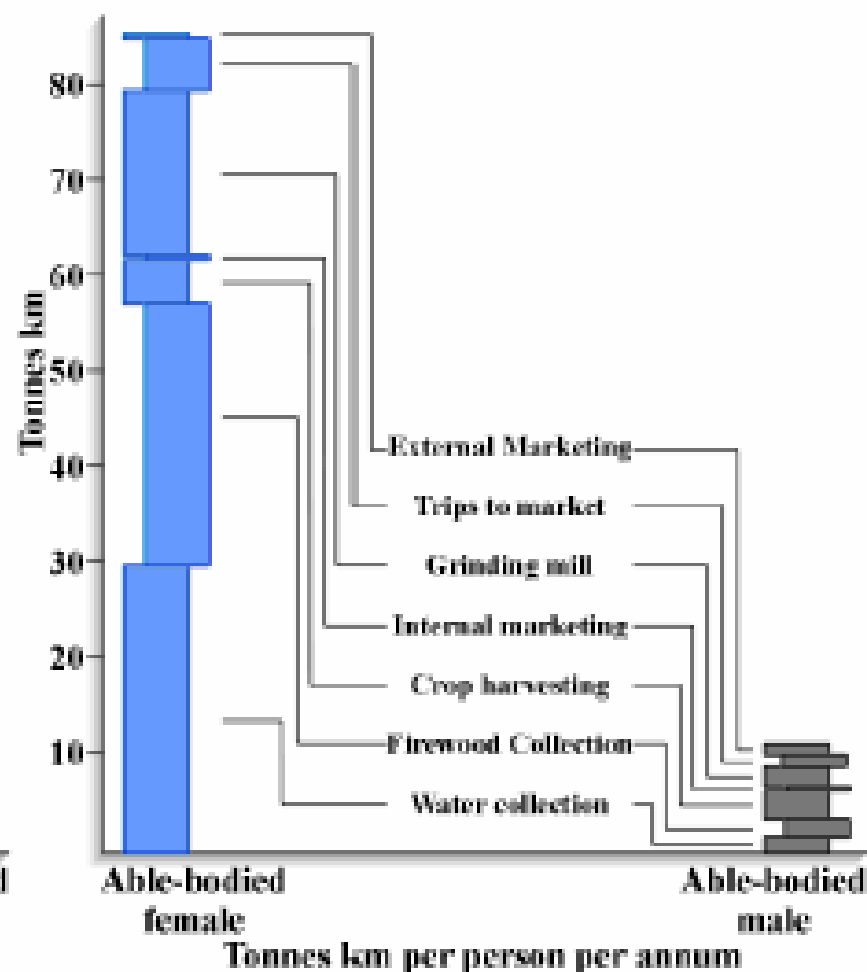
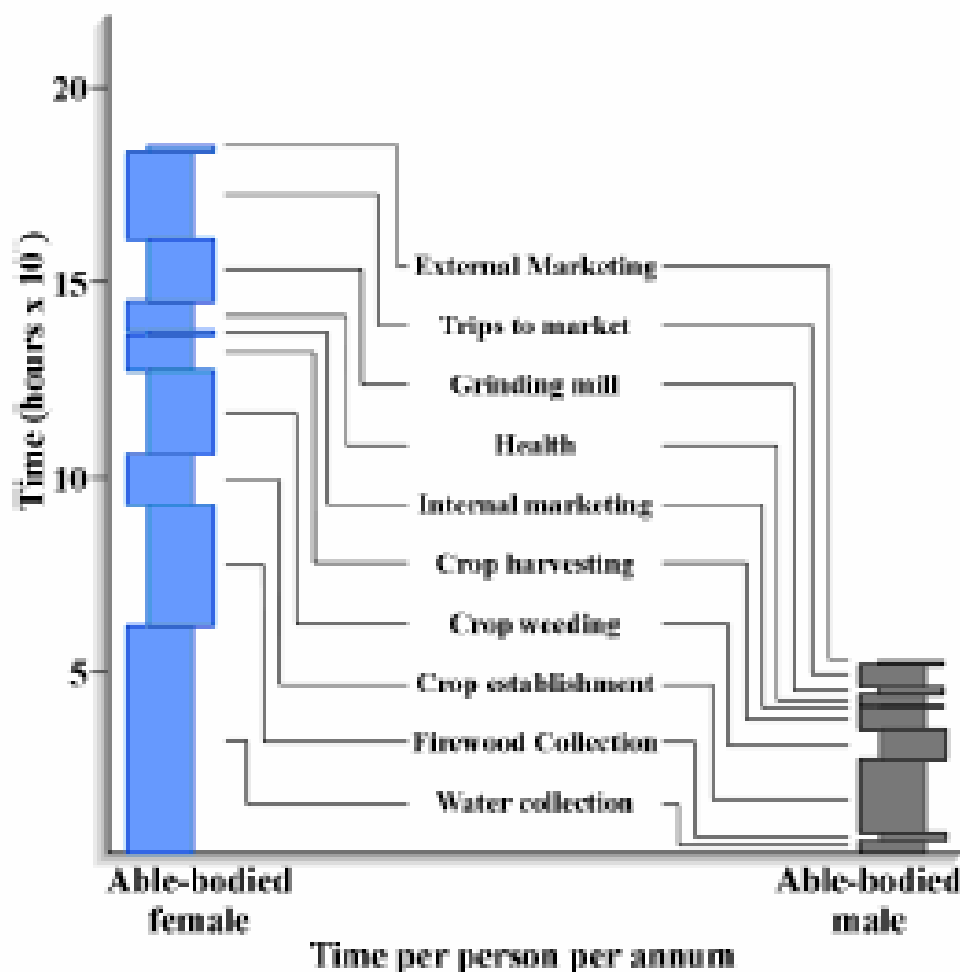


Source: IEA, 2003

2. Energy and Human Development

Benefits of transition to women

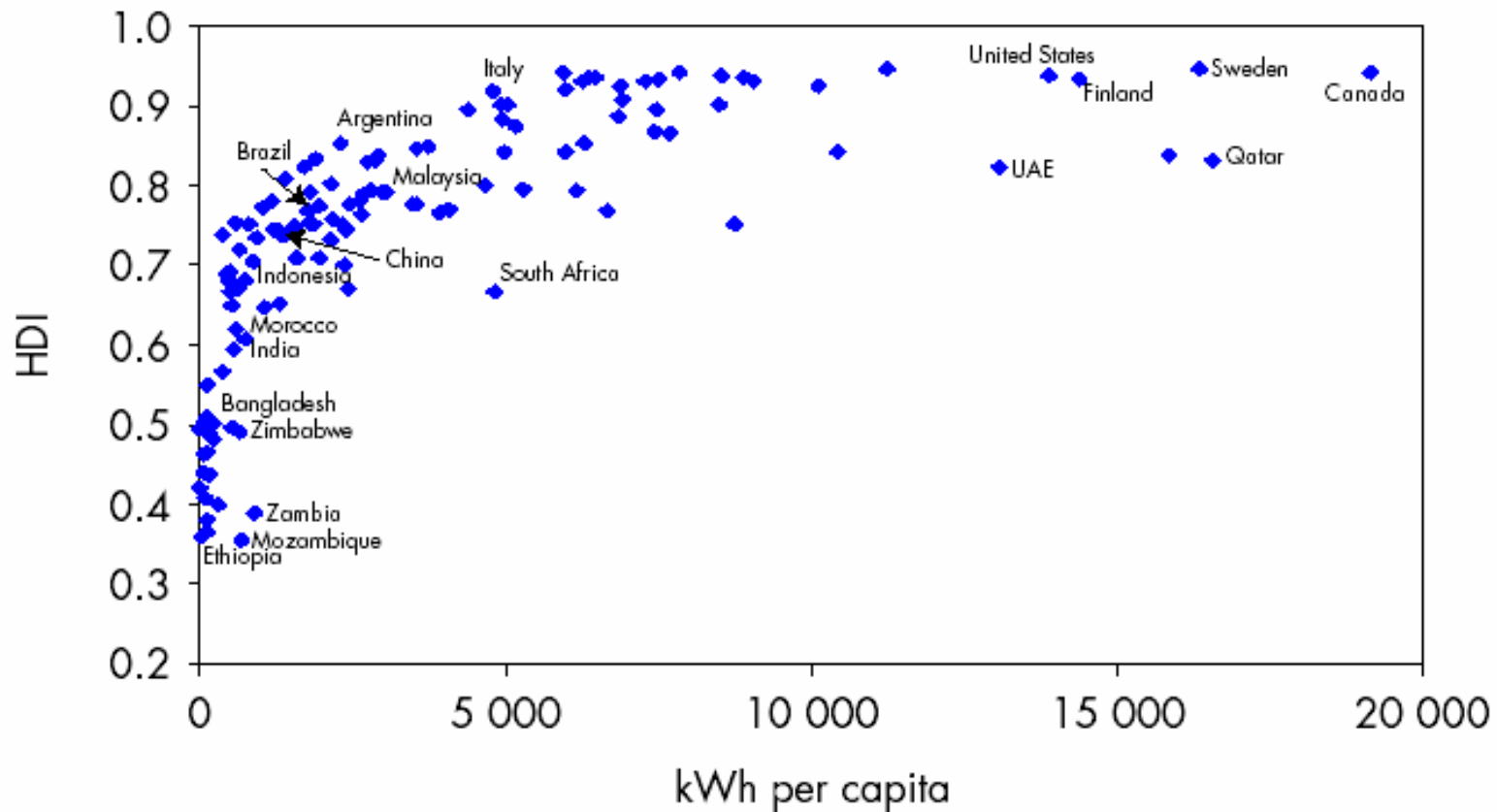
Time spent and the transport burden in Tanzania.



2. Energy and Human Development

Access to electricity

HDI and electricity consumption per capita 2002



2. Energy and Human Development

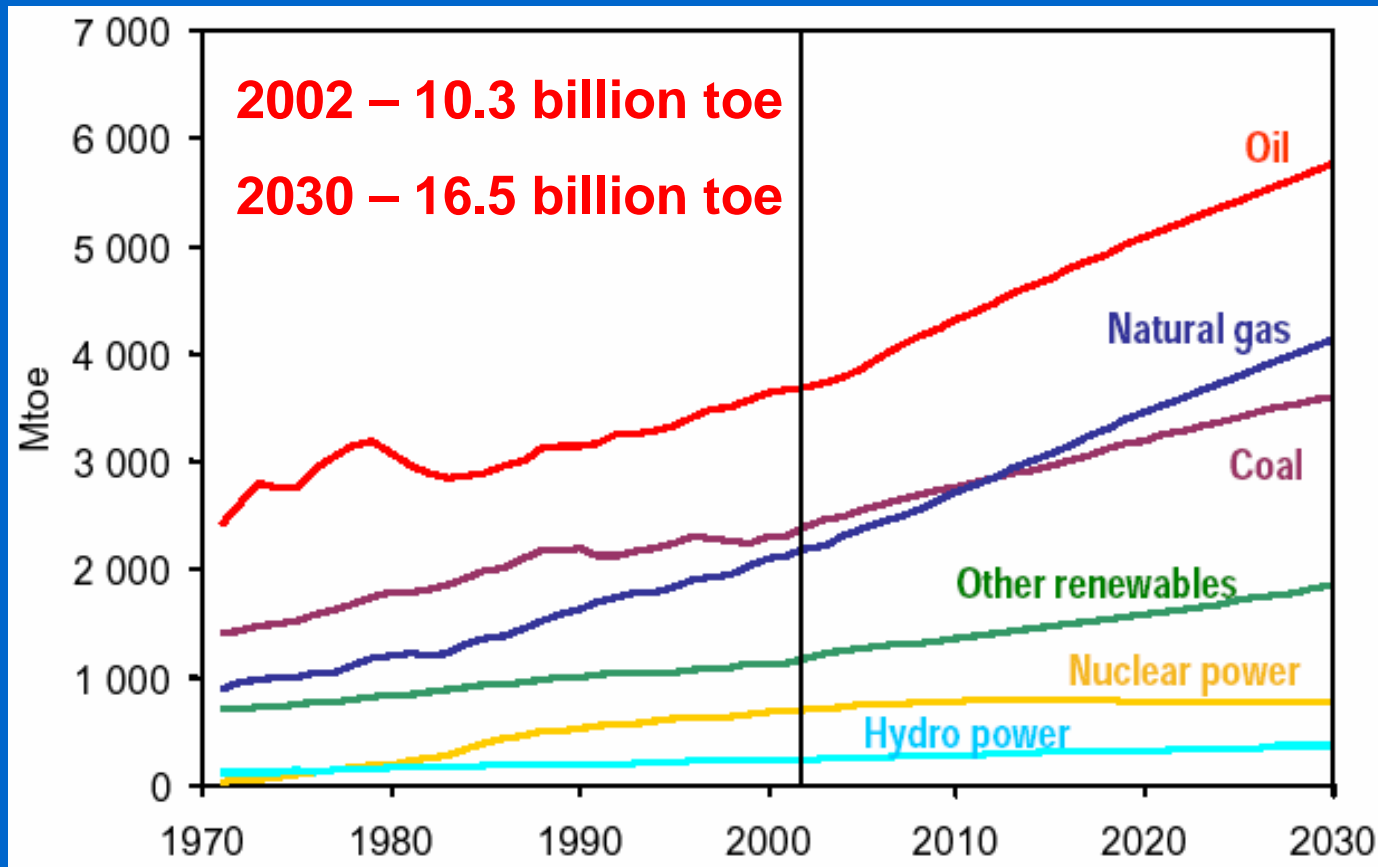
Access to electricity

Number of population without access to electricity 2002

Region	Rural	Urban	Total
Africa	416	118	535
<i>Sub-Saharan Africa</i>	408	117	526
<i>North Africa</i>	8	1	9
Developing Asia	871	148	1 019
<i>East Asia and China</i>	192	29	221
<i>South Asia</i>	679	119	798
Middle East	13	7	14
Latin America	39	1	46
Developing countries	1 339	275	1 615
OECD and transition economies	7	<1	7
World	1 347	275	1 623

3. Prospects for Electricity Development

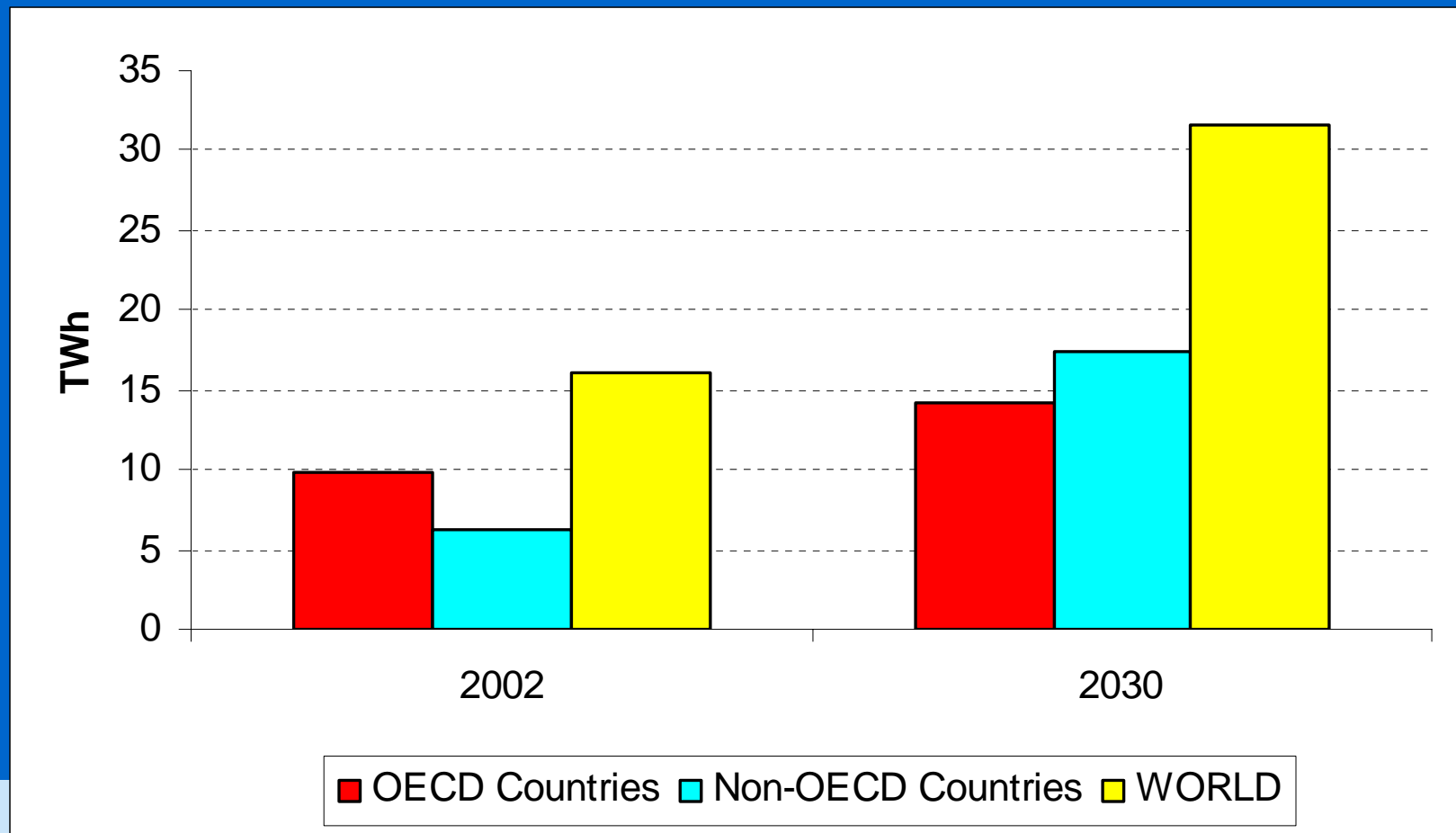
World Primary Energy Demand



3. Prospects for Electricity Development

Power Generation Projections

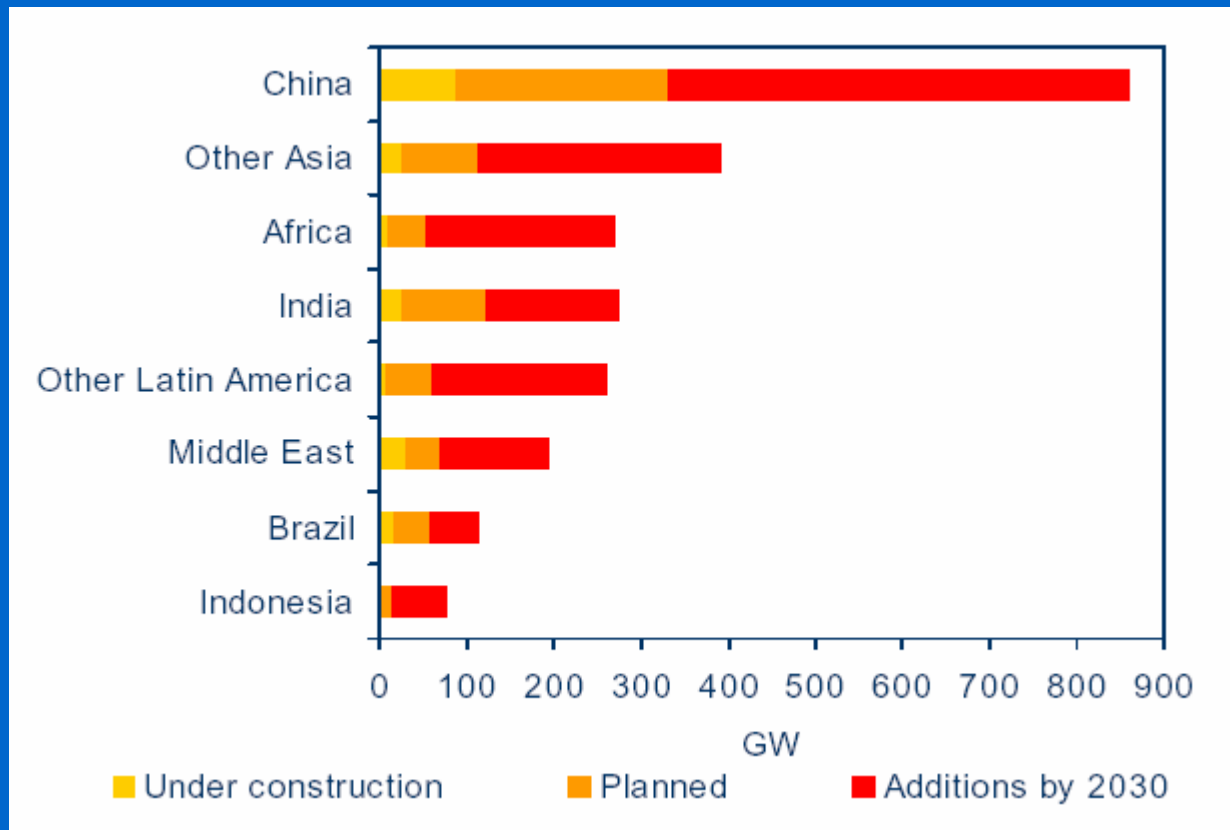
Electricity Generation, Reference Scenario, TWh



3. Prospects for Electricity Development

Capacity requirement in developing countries

Additions by 2030 – 2437 GW (in OECD countries – 1975 GW)



3. Prospects for Electricity Development

Electricity Access

Projected Electrification Rates by Region

global population: 2002 – 6.2 billion; 2030 – 8.1 billion

additional 2.1 billion population with access to electricity

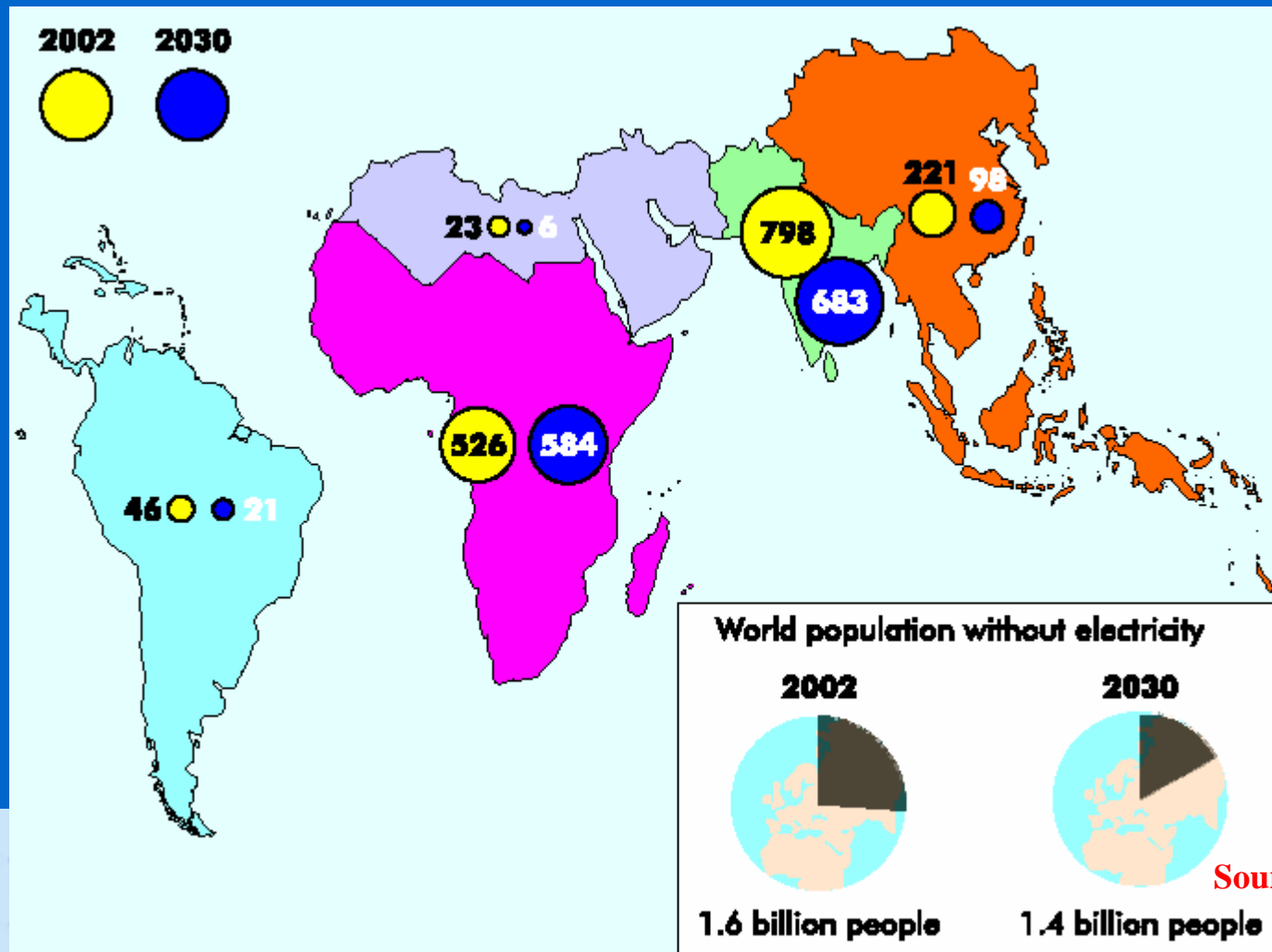
	2002	2015	2030
Africa	36	44	58
<i>North Africa</i>	94	98	99
<i>Sub-Saharan Africa</i>	24	34	51
South Asia	43	55	66
East Asia and China	88	94	96
Latin America	89	95	96
Middle East	92	96	99
Developing countries	66	72	78

3. Prospects for Electricity Development

Electricity Access

Electricity Deprivation

global population: 2002 – 6.2 billion; 2030 – 8.1 billion



Source: IEA, 2004

3. Prospects for Electricity Development

Energy and Millennium Development Goals

8 targets

- Eradicate extreme poverty and hunger
 - Reduce half the proportion of people living on < \$1 a day by 2015
 - Reduce half the proportion of people who suffer from hunger
- Achieve universal primary education
- Promote gender equality
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria and other diseases
- Ensure environmental sustainability
- Develop global partnership for development

3. Prospects for Electricity Development

Energy and Millennium Development Goals

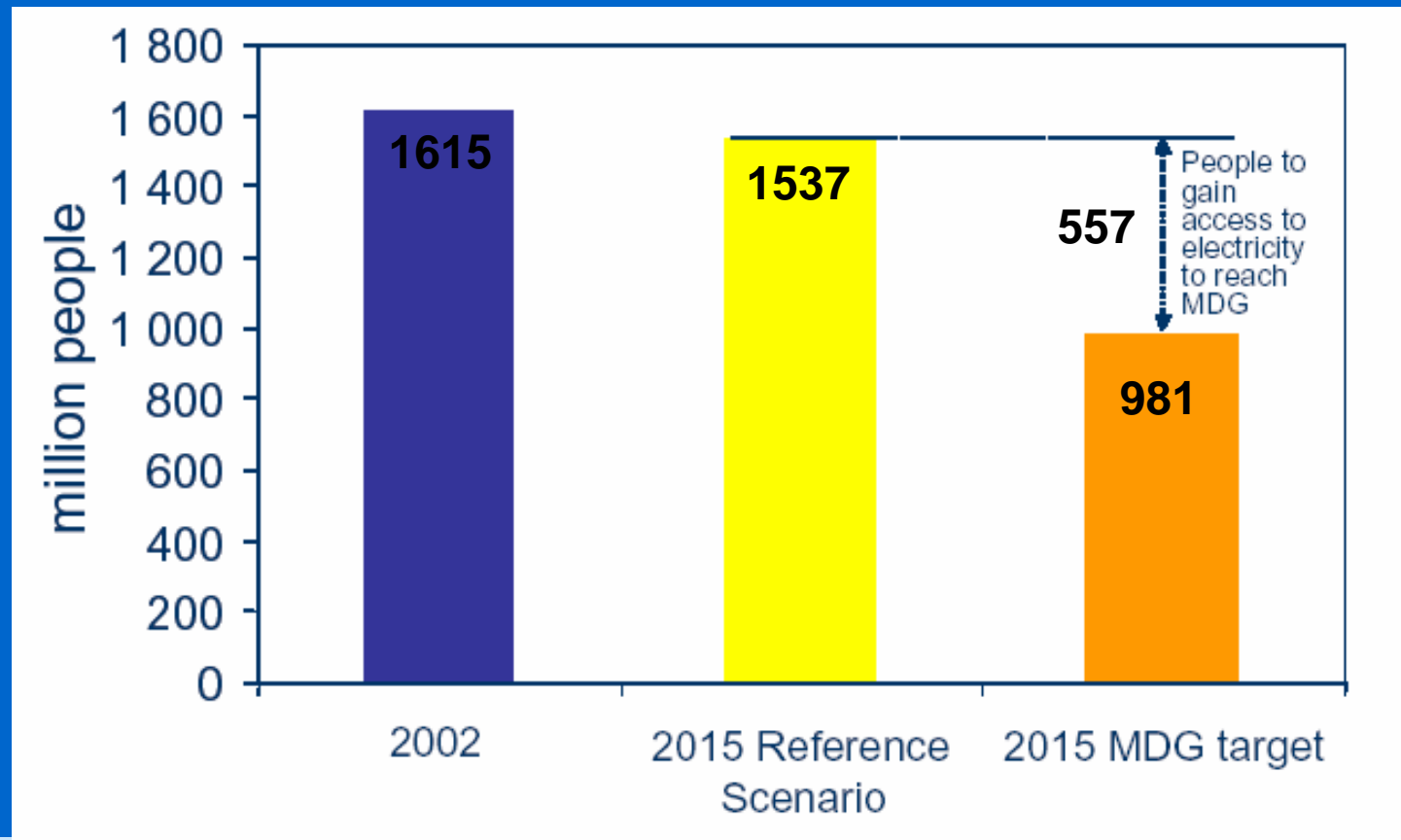
MDG compatible electricity consumption

Annual consumption per	Lighting/electrification
Households	75 kWh (15 kWh – SHS)
School	2,000 kWh
Hospital	50,000 kWh
Clinic	8,000 kWh
Health post	2,000 kWh

3. Prospects for Electricity Development

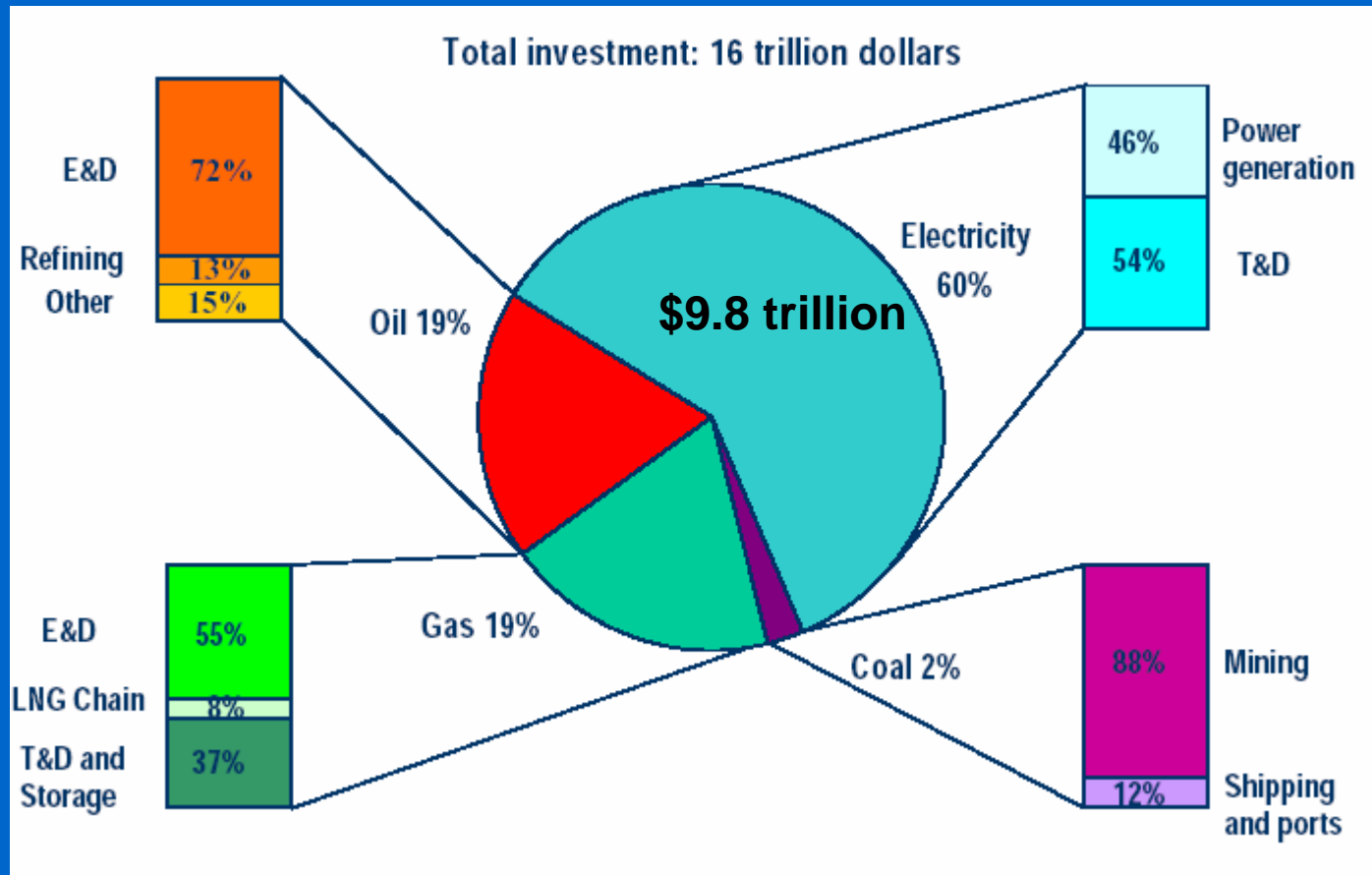
Energy and the Millennium Development Goals

People without electricity



4. Investment Requirements

Energy Investment 2003-2030



4. Investment Requirements

Electricity Sector Investments 2003-2030

	Capacity additions (GW)	Investment in electricity sector (\$ billion)			Total
		Generation	Transmission	Distribution	
OECD	1 975	2 167	498	1 276	3 940
Transition economies	372	287	79	287	653
Developing countries	2 437	2 153	962	2 090	5 205
WORLD	4 784	4 607	1 539	3 652	9 798

4. Investment Requirements

Impact of Meeting MDG targets

Reduce by half the population living on 1\$/day by 2015

Additional investment of \$16 billion per year

	<u>Population without electricity (million)</u>				Additional cumulative investment, 2003-2015 (\$ billion)
	2002	2015 Reference Scenario	2015 MDG Case*	Difference	
Africa	536	601	453	148	46
<i>North Africa</i>	9	3	1	2	1
<i>Sub-Saharan Africa</i>	526	598	452	146	45
South Asia	798	773	417	355	104
East Asia and China	221	127	100	28	22
Latin America	46	27	5	22	28
Middle East	14	9	5	3	3
Total	1 615	1 537	981	557	202

6. Key Challenges

Access to electricity services have economic growth and developmental implications, key challenges are:

- **how to provide access to safe, clean and reliable electricity**
 - 3.5 billion people (1.4 billion + 2.1 billion)
- **how to mobilize funds to finance the required investments in generation, transmission and distribution**
 - US\$ 363 billion per year (for the 2.1 billion people)
 - US\$ 16 billion per year (for the 500 million people - MDG)
 - US\$ **X** billion per year (for the additional 1.4 billion people)

7. Policy implications

- Good governance in the electricity sector is crucial to attracting investments
- Power industry reforms must be used as a tool in meeting electricity access goals